

# A Nanocomposite Approach to Microcrack Prevention in Composite Cryotanks, Phase I

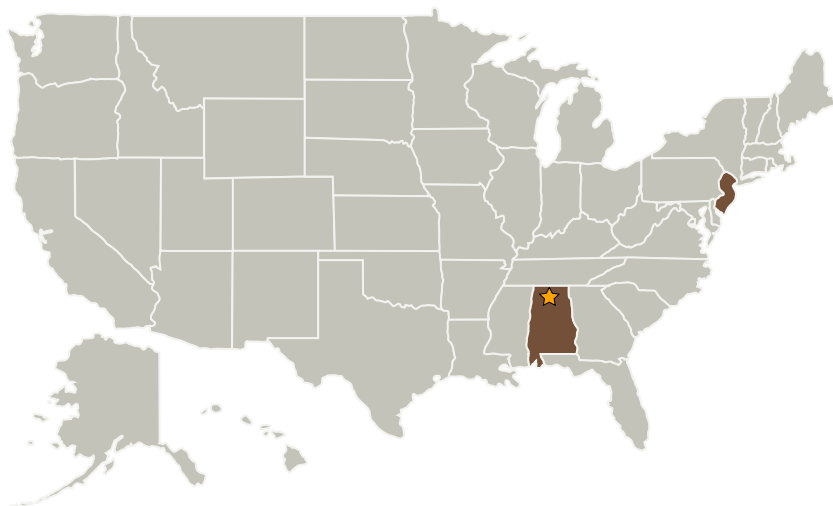
Completed Technology Project (2009 - 2009)



## Project Introduction

Nanomaterials and nanocomposites offer great potential for improvement in many applications. One such NASA application is the prevention of microcracking as well as improvement in impact strength at cryogenic temperatures of composite cryotanks/carbon fiber-reinforced filament wound composite overwrapped pressure vessels (COPVs) as used in liquid fuel propulsion systems and other related fiber-reinforced structures as used in space exploration. Replacement of the currently-used aluminum-lithium cryotanks with composite cryotanks is advantageous from a weight-saving standpoint, but these composite structures are susceptible to microcracks from long- and short-term exposure to cryogenic temperatures from fuel storage and space environments. In Phase I, we propose to demonstrate the feasibility of a novel engineered nanocomposite in a fiber-reinforced composite in order to eliminate microcracks and enhance the impact strength at cryogenic temperatures. The program is a collaborative effort with a leading developer and manufacturer of COPVs. A key aspect of the proposed program is that it combines nanoscale additives with modifications to the conventional epoxy matrix polymer structure and morphology in ways never done before. The Phase II program will build upon the Phase I demonstration effort by implementing the technology in other epoxy systems and fiber systems used in the filament winding process combined with technological advances made by our strategic partner; implementation of the technology to linerless cryotanks will be a major focus as a drop-in replacement for current aluminum-lithium cryotanks. In addition, we will implement the technology in other fiber-reinforced composite structures as may be applicable to NASA applications.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Marshall Space Flight Center (MSFC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
NEI Corporation	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Piscataway, New Jersey

## Primary U.S. Work Locations

Alabama	New Jersey
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## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX14 Thermal Management Systems
  - └ TX14.1 Cryogenic Systems
    - └ TX14.1.1 In-space Propellant Storage & Utilization